



INTERACTION EFFECT OF GENDER AND TEACHING METHOD ON ACADEMIC ACHIEVEMENT AND INTEREST OF BASIC SCIENCE STUDENTS IN UPPER BASIC EDUCATION

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ABSTRACT

This study investigated the interaction effects of teaching method and gender on students' academic achievement and interest in Basic Science in upper Basic Education. Quasi Experimental design was adopted for this study. Population of the study consisted of all the 6,325 junior secondary school year two (JS 2) Basic Science students in the 26 government secondary schools in Enugu education zone. The sample consisted of 186 JSS 2 students selected from 4 government owned junior secondary schools. Two of the schools were randomly assigned to experimental group while the other two were assigned to control group and used to investigate the interaction effect of teaching method (CAI) and gender on academic achievement and interest of students' in Basic Science. Two hypotheses were formulated to guide the study. The instruments were validated by experts. The internal reliability coefficient of BSAT was established to be 0.72 using Kuder Richardson (KR-20) while reliability coefficient of BSII was established to be 0.78 using Cronbach's alpha. The BSAT and the BSII were administered to the students as pretest and posttest for data collection. Mean and standard deviation were used to answer the research questions while ANCOVA was used to test the null hypotheses at 0.05 level of significance. The result revealed that there was no significant interaction effect of teaching method and gender on the mean interest scores of students in Basic Science. However, no significant interaction effect of teaching method and gender was found on the mean achievement scores of students' in Basic Science. The researchers recommended that teachers should ensure constant and effective utilization of CAI for instruction in Basic Science and science related subjects to enhance academic achievement and interest of students

Keywords: Basic Science, method, gender, interaction, achievement and interest.

INTRODUCTION

Basic Science was introduced in an attempt to present science as a unified whole. It aims at presenting a holistic view of science contents to the learners. Basic Science provides students with a sound foundation for further science education study, hence a



child that is not well grounded in Basic Science at this level may not show interest in offering core science subjects (Biology, Chemistry and Physics) at the senior secondary school level which are the prerequisites for studying science-oriented courses at the nation's tertiary institutions (Oludipe, 2011). The importance of Basic Science in the Nigerian education system is overwhelming. The importance of Basic Science has long been recognized all over the world as it prepares students for other scientific and technological skills. However, despite the importance of Basic Science in Nigeria, the students' performance in BECE continues to deteriorate year after year. Several reasons have been proffered for the high failure rate in Basic Science. Given the options, many students will not offer Basic Science (Obodo, Ani & Neboh, 2021). This implies the importance given to science in the society may not be realized because of persistent poor performance.

Globally, Basic science and technology are changing the world around us at an unbelievable rate. Any nation that ignores scientific and technological education may find it difficult to fit into the global advancement in science and technology. The 21st century classroom must be matched with the 21st century education which should be flexible, creative, challenging and complex. The state of science teaching and learning in Nigeria is a concern to all. According to Kanayo (2016), science teaching at various levels still retains the old conservative approach with the teacher, in most cases, acting as the repertoire of knowledge and the students as the passive recipients. In a conventional lecture-based teaching environment, students' involvement is restricted as teachers usually employ teaching methods which focus on information delivery and knowledge acquisition rather than encourage the construction of knowledge within the social context. Most of the time, the conventional lecture is conducted through a one-way communication, with limited opportunities for class discussion and active student involvement.

Studies confirmed that traditional science teaching still rely heavily on lectures, reading and teacher demonstrations in a typical Nigerian Basic Science classroom setting where unproductive teaching methods are often observed (Agogo & Onda, 2014; Ajeyalemi, 2017; Ikeobi, 2019). The traditional teaching strategies are said to be inadequate and inappropriate to attain conceptual learning and critical thinking (Opara, 2019; Obodo, Ani, & Mfon (2020). The predominant use of teacher-centred teaching methods in which the teacher acts as the custodian and dispenser of knowledge and students as receptors makes students passive listeners, taking notes from projected displays and from the lecturer's explanations (Talib, 2015). The traditional teaching method eliminates interactivity and the active involvement of students in the lesson as the student just pay attention and listen to the teacher. In the light of this, some researchers (Ahmed & Abimbola, 2011; Umar, 2011) warn that the traditional teaching method does not encourage insightful learning and long-term retention of some abstract concepts in Basic Science. Abolade & Olumorin (2014) have advocated that since the traditional method of teaching is no longer able to cope with meaningful learning, modern technological devices should be used constantly to effect qualitative and quantitative teaching and learning. Such



devices should be aimed at stimulating, capturing and sustaining the interest of the learner during the teaching-learning process (Kanayo, 2016). In order to overcome the problem of poor teaching method, it is necessary to look for alternative methods of instruction that will be effective in teaching certain concepts.

The alarming rate of students' underachievement in Basic Science at BECE examinations and at all levels may be due to a number of factors such as: lack of enough qualified and experienced Basic Science teachers, school location, sex of teachers, type and nature of public examination items and difficulties with teachers experience in teaching most of the Basic Science concepts. Other factors responsible for high failure rate include: students' inability to have scientific reading comprehension, in word-problem solving (Agwagah, 2005), lack of students' interest (Ogbonna, 2017), inadequate use of teaching aids (Enukoha, 2015) and carelessness of students (Ifamuyiwa, 2017). Some of the above listed problems were attributed to students' poor achievement in Basic Science in general, a good number of researchers laid the blame on the use of inappropriate teaching method which might lead to lack of interest in Basic Science concepts; these researchers include Agwagah (2005), (Ogbonna, 2017), Onyeabor (2017). The researchers agreed that ineffective teaching strategies were being adopted in the teaching of Basic Science which lead to students' lack of interest and subsequent poor performance. Ineffective methods of teaching employed by teachers at secondary school level in Nigeria have been noted as one of the key factors that lead to students' poor academic achievement as well as students' lack of interest in Basic Science (Ahmed and Abimbola, 2011; Umar, 2011).

Academic achievement is the ability to retain and subsequently remember things experienced or learned by an individual at a time (Ugwuanyi, Mwantok, Mbara and (Ogbu, 2018). It is the successful completion, through effort, of the acquisition of academic content and skills which is determined by the scores or grades that students get in an examination or test (Mutua, 2015 cited in Mbonu, 2018). Academic achievement is the extent to which a student has accomplished his/her short or long term goals. Students' academic achievement is the outcome of education and the extent to which a student has achieved their educational goal. It is the success in bringing an effort to a desired end. Achievement is the result, the success, the extent or ability, the progress in learning educational experiences (Olga, 2018). When achievement is low expectation, it is referred to as under-achievement or poor achievement. When students are successful in Basic Science examinations they will have the feeling of pride that they made success with their own efforts and skill. Small success can give students sense of achievement, on the other hand, persistent failure in Basic Science dampens students' interest.

Interest is concerned with choice or preference for a particular type of activity to the other. Interest is a feeling somebody has when one wants to know or learn more about something. It is a zeal or willingness to participate in an activity for which one derives some pleasure (Harbor-Peters cited in Ojo, 2015). The interest of students is thwarted by several factors, which include negative attitude of teachers and influence of other people's



attitude. Interest in Basic Science could be achieved when students are made to see the importance of what they are about to learn. It involves linking the new concept to be learnt to the learners' previous experience. Interest is used as a motivating force through which learning should take place (Ifenacho, 2012). Interest can also be generated and sustained through several methods. These include motivation, relevant set induction technique, use of scientific games, effective use of instructional materials, most especially use of computer-assisted instructional (CAI) strategy.

Computer-assisted instructional (CAI) according to Qureshi (2020) is defined as an interaction between a student, a computer controlled display and a response entry device for the purpose of achieving educational outcomes. CAI is seen in Basic Science as an instructional method which help to enhance students' academic achievement and interest cum learning and increase students' test scores. Kuti (2016) affirms that the use of computer-based instructional package presentations support visual and verbal formats supplemented with pictures, animations, texts, and narrations could cater for the limitations of the traditional method. computer-assisted instructional (CAI) strategy has shown some usefulness. Hence, one of the ways of addressing the challenges of poor academic achievement and students' lack of interest is through the integration of ICT's and other computer-based instructional package into teaching and learning that promotes meaningful learning and help to improve the performance of students in Basic Science. The use of innovative strategies as well as instructional media that will bring meaningful learning of Basic Science becomes imperative. However, the method being advocated in this study is the one which involves the use of computer-assisted instructional (CAI) strategy irrespective of gender.

The interaction effects of gender and teaching methods on students' achievement in teaching Basic Science at junior secondary school level in Ogun State was investigated by Adeyemi (2012). Adeyemi revealed significant interaction effect of treatment and students' academic achievement in Basic Science. Akintade (2017) investigated the interaction effects of gender and teaching methods on students' academic achievement and attitude towards latitude and longitude in Nigerian secondary school in Nigeria. Akintade (2017) revealed that there was no interaction effect related to treatment, gender and students' subject area in the post-test. The study of Umoru and Adekunle(2019) revealed that the interaction effects of gender and teaching methods was not significant on students' achievement and retention in Basic Science. This means that gender and teaching method did not significantly interact over the students' achievement. On whether there was no significant interaction effect of teaching method and gender on students' interest. Egara (2010) noted that there was no significant interaction effect between the teaching method and gender on students' interest score. This shows that teaching method (CAI) enhance and sustains interest of both male and female (gender) students. That is, it is gender unbiased and does not interact over the students' academic achievement and interest. Therefore, the researchers deemed it necessary to investigate the interaction effect of



gender and teaching method on Basic Science students' academic achievement and interest.

The objectives of teaching and learning of Basic Science in upper basic education is to enable students to develop interest in science; acquire basic knowledge and skills in science; apply scientific knowledge and skills to meet societal needs; become aware of numerous career opportunities provided by science; become prepared for further studies in science; avoid drug abuse and relative vices, be safety and security conscious. It has been suggested that one way to enhance the academic achievement of students is through the use of learner centered method such as Computer Assisted Instruction (CAI). The academic achievement reports of Basic Science students in upper Basic Education have repeatedly showed that failure in Basic Science may be blamed on the regular use of conventional teaching method of instruction. Researchers attributed this poor academic achievement to poor instructional method of teaching, paucity of facilities and inability of lecturers to introduce learner centered method. For effective teaching and learning of Basic Science in Upper Basic, teachers should consider the use of this effective CAI as teaching strategy to enhance and boost the academic achievement and interest of students'. Hence, the problem of this study is 'What is the interaction effect of teaching method (CAI) and gender on academic achievement and interest of students in Basic Science in Upper Basic Education in Enugu State?

PURPOSE OF THE STUDY

The purpose of this study was to find out the interaction effect of teaching method and gender on the academic achievement and interest of students in Basic Science. Specifically, the study seeks to:

1. Find out the interaction effect of teaching method and gender on students' interest in Basic Science.
2. Find out the interaction effect of gender and teaching method on students' academic achievement in Basic Science.

RESEARCH QUESTIONS

1. What is the interaction effect of teaching method and gender on students' interest in Basic Science?
2. What is the interaction effect of gender and teaching method on students' academic achievement in Basic Science?

HYPOTHESES

- H01: There is no significant interaction effect of teaching methods and gender on students' interest in Basic Science.
- H02: There is no significant interaction effect of gender and teaching methods on students' achievement in Basic Science.



METHOD

The design of this study was quasi experimental. Specifically, the non-equivalent control group design involving two groups was adopted for the study. Population of the study consisted of all the 6,325 junior secondary school year two (JS 2) Basic Science students in the 26 government secondary schools in Enugu education zone. The sample consisted of 186 JSS 2 students selected from 4 government owned junior secondary schools. Two of the schools were randomly assigned to experimental group while the other two were assigned to control group and used to investigate the interaction effect of teaching method (CAI) and gender on academic achievement and interest of students' in Basic Science. Two hypotheses were formulated to guide the study. The instrument was face and content validated by experts from educational foundations department from Alex Ekwueme Federal University Ndufu Alike Ikwo. Their comments and suggestions were used in restructuring the test items that appeared in the final draft of the questionnaire. The internal reliability coefficient of BSAT was established to be 0.72 using Kuder Richardson (KR-20) while reliability coefficient of BSII was established to be 0.78 using Cronbach's alpha. The BSAT and the BSII were administered to the students as pretest and posttest for data collection. Mean and standard deviation were used to answer the research questions while Analysis of Covariance was used to test the null hypotheses at 0.05 level of significance. The result revealed that there was no significant interaction effect of teaching method and gender on the mean interest scores of students in Basic Science. Prior to the treatment, Pre-test was administered to the students on commencement of the treatment and the result collected from each student were recorded. At the end of the teaching period that lasted for a period of eight weeks, a post test was conducted for the experimental and control group. The data collected were analyzed using mean and standard deviation to answer research question while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

RESULTS

Research Questions One: What is the interaction effect of teaching method and gender on students' mean interest in Basic Science?

Table 1: Mean and standard deviation of interaction effect of teaching methods and gender on students' interest in Basic Science

Groups	Gender	N	Mean	Std. Dev.
Experimental Group	Male	45	29.42	7.30
	Female	50	30.90	7.97
Control Group	Male	49	27.80	5.98
	Female	42	27.40	6.15

Result of the analysis in Table 1 revealed that male students exposed to experimental group (CAI) strategy had higher mean interest ratings of 29.42 and standard deviation of 7.30 as



against their male counterparts exposed to control group (conventional lecture method) that had mean interest ratings of 27.80 with standard deviation of 5.98. On the other hand, female students exposed to experimental group (CAI) strategy had higher mean interest ratings of 30.90 and standard deviation of 7.97 while their female counterparts in the control group (conventional lecture method) had mean interest ratings of 27.40 with standard deviation of 6.15. The results do not suggest ordinal interaction effect between teaching methods and gender on students' interest in Basic Science. This is because the interests mean ratings of male students in both experimental and control groups were higher than the female students. Therefore, the effect of teaching methods on students' interest is not the same for male and female students. Hence, this is an indication that there may be no interaction effect of teaching methods and gender on students' interest in Basic Science.

Hypotheses One: There is no significant interaction effect of teaching methods and gender on students' interest in Basic Science.

Table 2: Summary of Analysis of Covariance (ANCOVA) Test for Significant Interaction Effect of gender and teaching method on students Interest in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18053.748 ^a	4	4513.437	114.194	.000	.701
Intercept	16145.881	1	16145.881	408.507	.000	.677
PretestInt	682.076	1	682.076	27.490	.000	.081
Method	17427.173	1	17427.173	440.925	.000	.693
Gender	25.288	1	25.288	.640	.425	.003
Method * Gender	.005	1	.005	.000	.991	.000
Error	7707.207	181	39.524			
Total	453851.000	186				
Corrected Total	25760.955	185				

The result of analysis in Table 2 shows that the probability value of .991 associated with teaching methods and gender is greater than 0.05 level of significance; $F(1, 181) = .000$, $P = .991$. Thus, the null hypothesis of no significant interaction effect of teaching methods and gender on students' mean interest ratings in Basic Science was accepted. The result of interaction effect was also interpreted using screen plot as shown in figure 1 below.

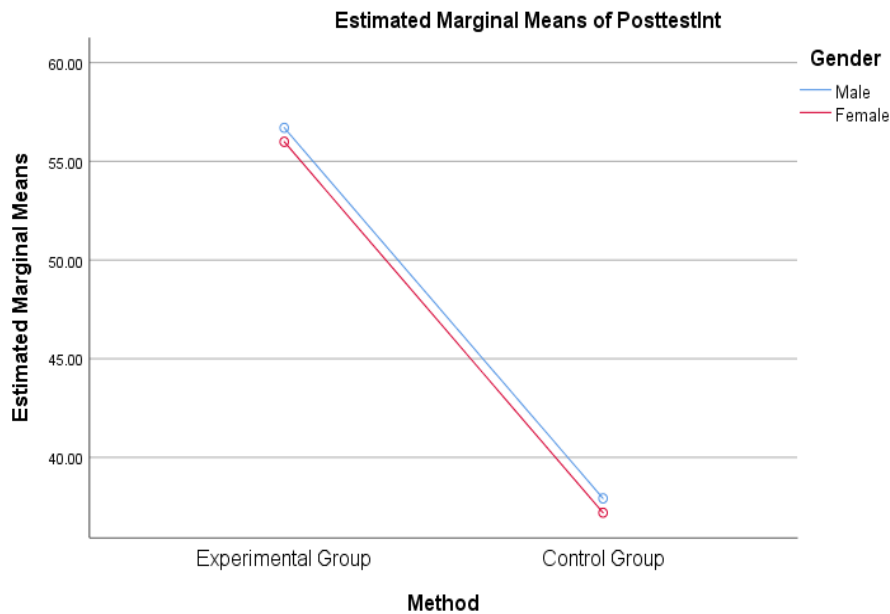


Figure 1 Graph of the interaction effect of teaching methods and gender on students' interest in Basic Science.

The screen plot in figure 1 shows that there is no interaction effect of teaching methods and gender on students' interest in Basic Science. This is indicated by the separate lines for the male and female students' interest in Basic Science in the respective two teaching methods. That is to say that, the connecting cell mean in the diagram is parallel.

Research Questions Two: What is the interaction effect of teaching method and gender on students' mean achievement scores in Basic Science?

Table 3: Mean and standard deviation of interaction effect of teaching methods and gender on students' achievement in Basic Science

Groups	Gender	N	Mean	Std. Dev.
Experimental Group	Male	45	25.77	3.19
	Female	50	23.64	3.10
Control Group	Male	49	19.96	3.65
	Female	42	19.34	3.84

Result of the analysis in Table 2 revealed that male students exposed to experimental group (CAI strategy) had a higher mean achievement score of 25.77 and standard deviation of 3.19 as against their male counterparts exposed to conventional lecture method that had



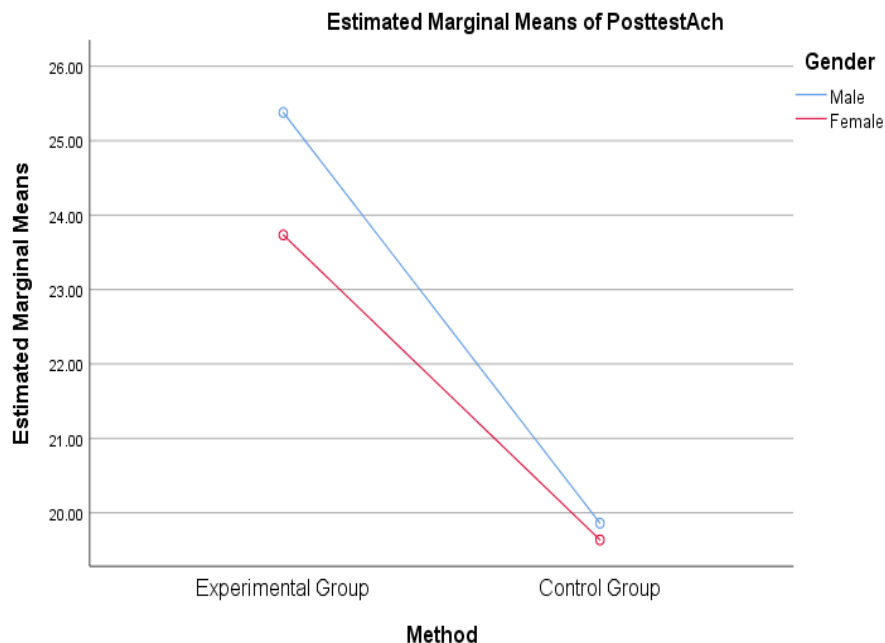
mean achievement score of 19.96 with standard deviation of 3.65. On the other hand, female students exposed to experimental group (CAI) strategy had higher mean achievement score of 23.64 and standard deviation of 3.10 while their female counterparts in the conventional lecture method had mean achievement score of 19.34 with standard deviation of 3.84. The results do not suggest ordinal interaction effect between methods of teaching and gender on students' achievement in Basic Science. This was because at all the levels of gender, the mean achievement scores were higher for students in the experimental group than those in the control group.

Hypothesis 2: There is no significant interaction effect of teaching method and gender on students' achievement in Basic Science.

Table 4: Table 2: Summary of Analysis of Covariance (ANCOVA) Test for Significant Interaction Effect of gender and teaching method on students Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1530.194 ^a	4	382.548	33.826	.000	.410
Intercept	2538.190	1	2538.190	224.435	.000	.535
PretestAch	172.910	1	172.910	31.801	.000	.073
Method	1124.394	1	1124.394	99.422	.000	.338
Gender	41.044	1	41.044	3.629	.058	.018
Method * Gender	24.973	1	24.973	2.208	.139	.011
Error	2205.306	181	11.309			
Total	100096.000	186				
Corrected Total	3735.500	185				

Table 4 shows that the exact probability value of .139 associated with teaching methods and gender is greater than 0.05 level of significance; $F(1, 181) = 2.208$, $P = .139$. Thus, the null hypothesis of no significant interaction effect of teaching methods and gender on students' achievement in Basic Science was upheld. The researcher therefore, concludes that the interaction effect of teaching methods and gender on students' achievement in Basic Science is not significant. The result of interaction effect was also interpreted using the screen plot as shown in figure 2 below.



Covariates appearing in the model are evaluated at the following values: PretestAch = 15.1350

Figure 2: Graph of the Interaction Effect of teaching methods and gender on Mean Achievement Scores of Students

The screen plot in figure 2 shows that there is no interaction effect of teaching methods and on mean achievement scores of junior secondary school students in Basic Science. This is indicated by the separate lines for the male and female students' achievement in the respective two teaching methods groups. That is to say that, the connecting cell mean in the diagram is parallel.

DISCUSSION OF FINDINGS

The findings of this study revealed that there is no interaction effect of gender and teaching method, on students' interest in Basic Science. The findings on table 1 showed that there was no statistically significant interaction effect of teaching method and gender on the mean interest scores of students in Basic Science. This was in line with the findings of Egara (2010) that there is no significant interaction effect of treatment and students' interest in social studies. The finding is also in line with the findings of Egbunonu (2014) who found no interaction effect of gender and instructional treatment, on students' interest. Hypothesis two sought to find out whether there existed a significant interaction effect between the teaching method (CAI) and gender on students' achievement in Basic Science topics taught. The findings of this study revealed that there is no interaction effect of gender and teaching method, on students' achievement in Basic Science. This finding is in line with that Adeyemi (2012); Mbonu (2018), Ezedinma and Nwosu (2018), and Okotcha



(2018) who agreed from their study that there is no significant interaction between teaching method and gender on students' achievement in Basic Science and social studies. This finding appeared to be consistent with those of Akintade (2017) who found no interaction effect of treatment and gender on academic achievement of students. This means that the teaching method (CAI) did not combine with gender to affect students' academic achievement and interest. Hence, the teaching method is gender friendly.

CONCLUSION AND RECOMMENDATIONS

Based on the results of this study, the researchers concluded that there is no interaction effect of teaching method and gender in the academic achievement and interest of students in Basic Science. It is gender unbiased and hence, produces no significant interaction effect in the Basic Science academic achievement and interest of male and female (gender) students in Upper basic Education.

Thus, the following recommendations are proffered:

1. Teachers should ensure constant and effective utilization of CAI for instruction in Basic Science and science related subjects in Upper Basic Education, senior secondary and vocational schools to enhance academic achievement and interest of students
2. Government should provide (Lower, Middle and Upper Basic Education, senior secondary and vocational schools) with computers and internet facilities to enable students maximize the benefits of CAI.
3. Government and professional bodies like STAN should sponsor further research on other ways of enhancing academic achievement and interest of students in Basic Science.
4. Curriculum planners should formally adopt CAI for instruction in Basic Science in Upper Basic Education and ensure its wide application.

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